

# (12) UK Patent Application (19) GB (11) 2 148 565 A

(43) Application published 30 May 1985

(21) Application No 8328119

(22) Date of filing 20 Oct 1983

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(51) INT CL<sup>4</sup>  
G01D 4/00 1/04 5/26 G01R 11/56

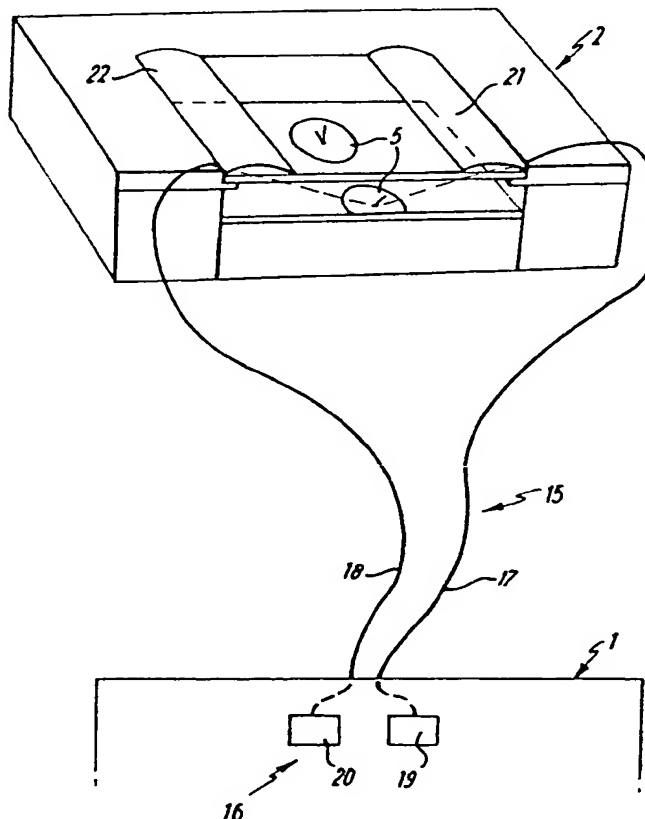
(52) Domestic classification  
G4D 402 AX  
G1U 39X11 BE

(56) Documents cited  
GB A 2053538 GB A 2046924 GB A 2017937  
GB A 2046925 GB A 2018440

(58) Field of search  
E4D  
E1U

## (54) Monitoring devices

(57) Consumption of a utility, such as gas or electricity, is monitored with a computing system (1) associated with an existing consumption meter (2). The computing system may have optical links which transfer data from the meter, a computer device which converts the picked-up data e.g. to a cost value, and an output device which displays the computed value. The input device may be a transducer which can be applied externally to the meter e.g. an optical transducer which responds to movement of digits or dial needles of the meter. Alternatively meter readings may be fed to the computing system by a keyboard.



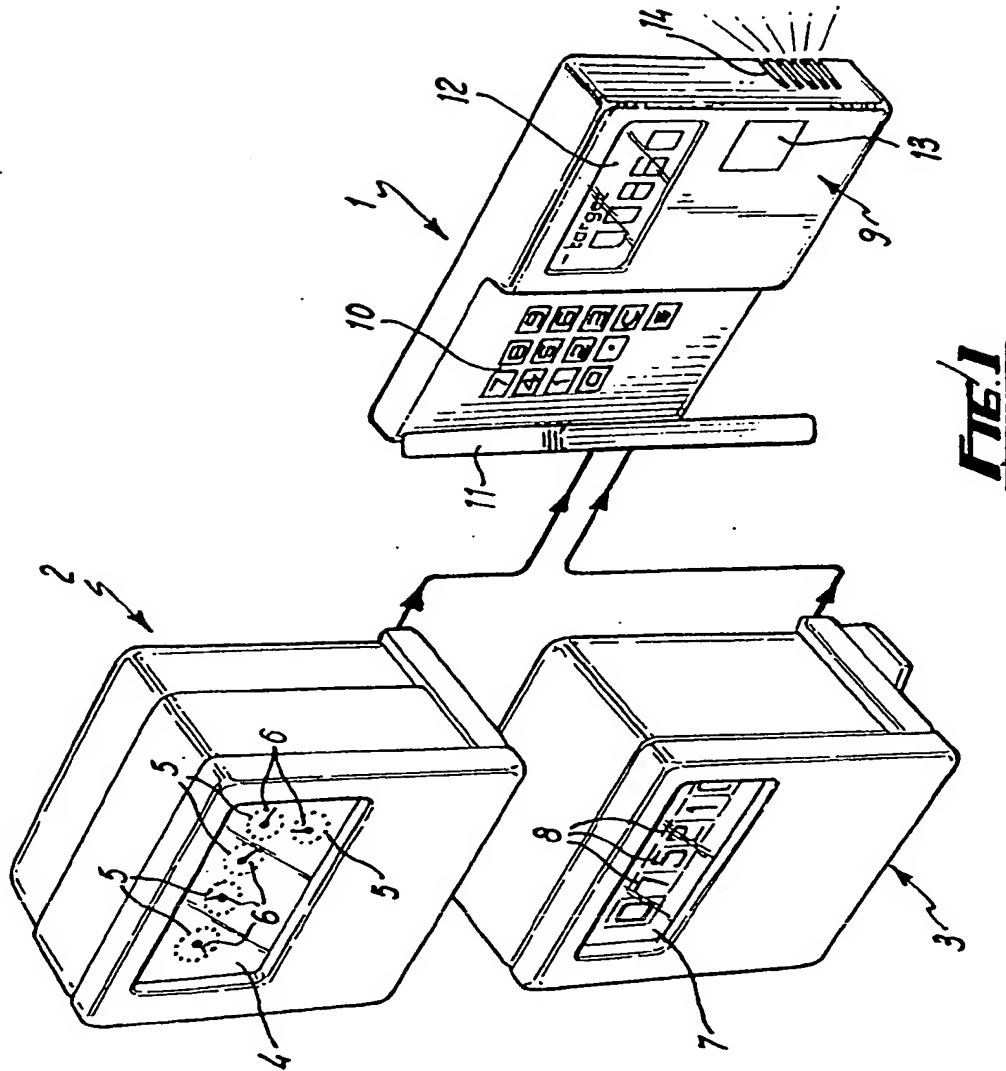
**FIG. 2**

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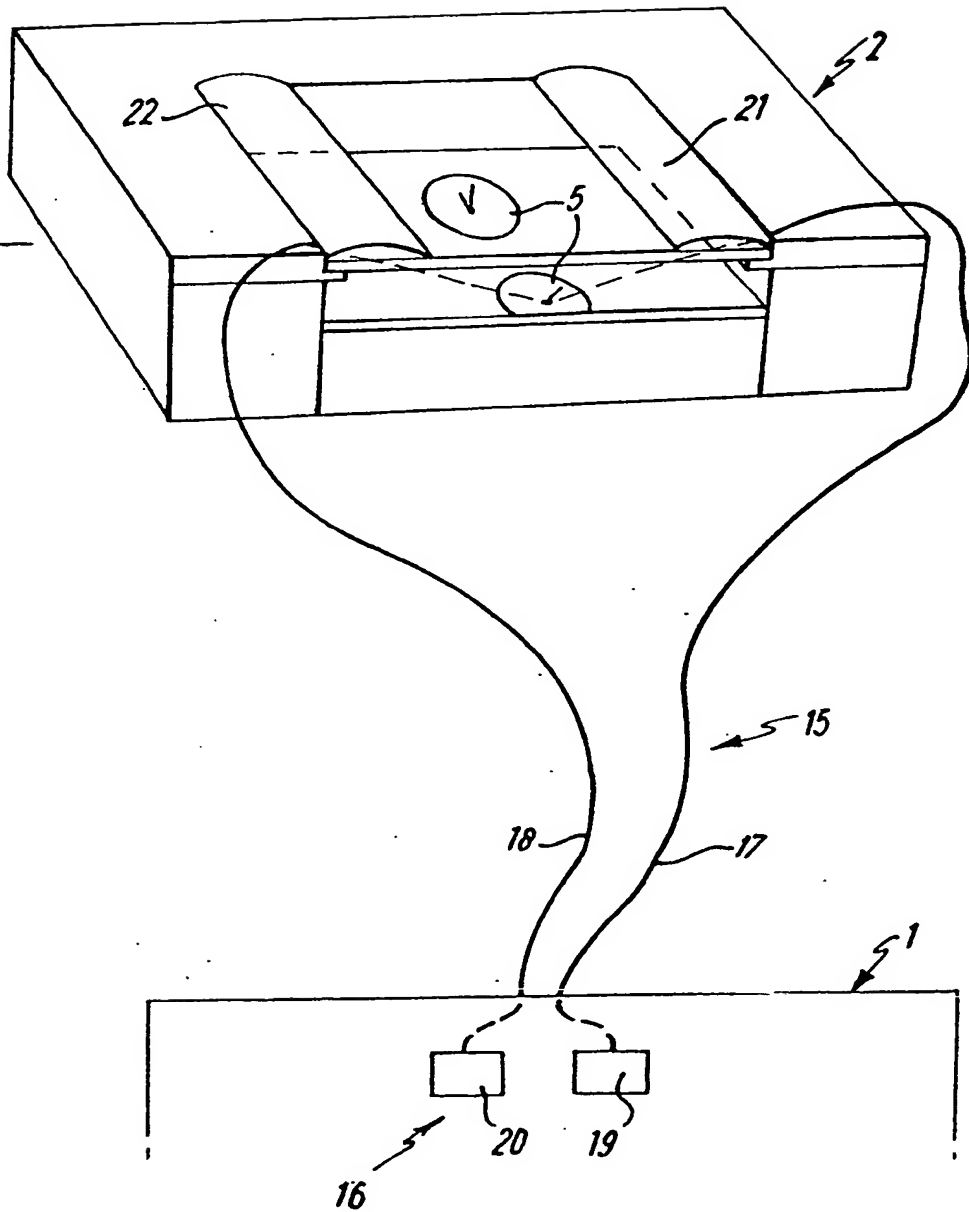
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**FIG. 2**

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## SPECIFICATION

### Monitoring devices

- 5 This invention relates to a monitoring device for monitoring the consumption or rate of use of energy or a utility or service; such as electricity, gas, oil, water, telephone or the like, as supplied under material condition to  
10 domestic or other premises.

In the context of domestic premises supplied with electricity and fuel gas, the usual domestic electricity and gas meters provide information in a form which may not be  
15 readily interpretable as a meaningful rate or extent of consumption. Accordingly, it is not uncommon for energy to be used wastefully and consequently for undue expenditure to be incurred, often unexpectedly, by the user.

- 20 An object of the present invention is to provide a monitoring device which can be used to remedy this.

According to the invention therefore there is provided a monitoring device for use with an  
25 existing meter applied to energy or a utility or service supplied to premises, said device comprising an input means for inputting consumption data received from said meter, a computing means for computing an equivalent value  
30 in accordance with predetermined conversion data, and an output means for providing an output indicative of said computed equivalent value.

With this arrangement the device can derive  
35 from the meter information relating to the rate or extent of consumption and this can then be presented, via the output means, in a meaningful form to the user.

It is visualised that the device will find  
40 particular application in relation to gas and/or electricity consumption in domestic premises. However, the invention is not intended to be restricted to this field of application and the device may find use in relation to other kinds  
45 of premises and/or to other supplied utilities/services such as fuel oil, water, telephone etc. Moreover, it is to be understood that the device may be adapted for utilisation in relation to a single meter or alternatively for  
50 multiple meters of the same or different kind.

With regard to the said input means this may take any suitable form and may be manually and/or automatically operable for input of data as desired.

55 In accordance with one embodiment, the input means may comprise a keyboard or other arrangement of manual controls or switches via which a visually observed meter reading can be entered into the monitoring  
60 device.

In accordance with a further embodiment, the input means may comprise a suitable direct link which is connected to the monitoring device and is connected or disposed in  
65 relation to the meter so as to pick up and

relay automatically meter readings. In so far as the link is applied to an existing meter, the connection or association between the link and the meter preferably is effected externally thereof and without interference with or modification of the normal operation of the meter. Thus, the link preferably includes a transducer responsive to a normal function of the meter.

Said transducer may be an optical device  
75 responsive to movement of an externally visible part such as a needle movable around a dial, movable digits, rotating discs or drums, or the like, and the optical device may simply respond to movement, for example as a consequence of disruption of transmission or reflection of light or, alternatively the device may be capable of identifying the shape or disposition of an object, such as a needle or digit, using pattern recognition techniques. In  
80 a particularly preferred embodiment an optical device is used which comprises a substantially flat lens system which can be applied to the surface of a meter front glass or viewing window so as to permit normal visual inspection of the meter display whilst also acting to direct light beams onto said display from a light source and from said display after reflection thereby to a light sensor. The light source and sensor may be located adjacent the meter  
85 in which case the link may comprise an electric cable. Alternatively the light source and sensor may be located remotely e.g. in the monitoring device and optical fibres may be used to transmit light to and from the meter.

Other kinds of transducers are also possible including, for example, sound transducers responsive to sounds occurring in the meter for example clicking sounds caused by incrementing of rotary metering mechanisms, and magnetic or inductive or capacitive transducers responsive to movement or actuation of appropriate meter components.

Where the input means relies wholly on manual entry of data it will be appreciated  
110 that repeated entries on different occasions will be required to enable rate or extent of consumption to be monitored. Provision may be made for time elapse between entries to be automatically recorded, by incorporation of a clock and/or calendar in the monitoring device, or, alternatively it may be necessary also to enter the time and/or date manually.

Where automatic data entry is utilised this may be initiated automatically or manually at appropriate intervals or continuously and, as appropriate and as required, the monitoring device may incorporate a clock and/or calendar or may require manual entry of time and/or date data.

125 With regard to the said computing means this is preferably operable to compute a cost value in relation to the monitored rate/extent of consumption in accordance with predetermined cost data, for example relating to the cost per unit consumed and any additional  
130

charges as levied by the supplier of the utility/service in question. The predetermined data may be permanently incorporated in the computing means or, alternatively, provision  
 5 may be made for entering this manually or automatically as desired. The computed cost value may relate only to consumption which has already occurred and/or may be extrapolated on any suitable basis to anticipate or  
 10 forecast future consumption.

With regard to the said output means, this may take any suitable form and thus for example may comprise a digital or other quantitative display, and/or an audible or visual  
 15 warning device or other qualitative display, and/or a remedial device which acts to modify the rate/extent of consumption. The output means may produce an appropriate indication continuously or on request and/or only  
 20 when a pre-set target is reached or exceeded.

The invention will now be described further by way of example only and with reference to the accompanying drawings in which:

Fig. 1 is a diagram illustrating one form of  
 25 a monitoring device according to the invention;

Fig. 2 is a part-sectional diagrammatic illustration of a modified version of the device of Fig. 1.

30 With reference to Fig. 1, there is shown a monitoring device 1 for use in conjunction with gas and electricity meters 2, 3 in domestic premises.

The meters are of a wholly conventional  
 35 nature and have closed housings firmly fixed to a building wall or the like. The gas meter 2 as shown has a front glass window 4 through which dials 5 can be seen, each such dial having a central needle 6 rotatable around a circular scale. The electricity meter 3 as  
 40 shown has a front glass window 7 through which rotatable digit-bearing counter reels 8 can be seen.

The monitoring device 1 is mounted at a  
 45 convenient position alongside the meters 2, 3 and has a housing containing battery- or mains-powered electronic circuitry. At one side of a front wall 9 of the housing there is a keyboard 10 behind a hinged cover 11. At  
 50 the other side of the front wall there is a digital display 12, for example of the LCD kind, and beneath this a control button 13. Behind one side of the housing there is an audible alarm device 14. The electronic circuitry in the housing includes a computing  
 55 circuit, a timing circuit, drive circuits for the alarm 14 and the display 12 and interface circuits connected to the keyboard 10 and the control button 13.

60 In use, data is entered into the monitoring device via the keyboard 10, such data including for example: the real time, the cost per unit for consumption of gas and also electricity, the target cost (i.e. desired upper cost  
 65 limit for a predetermined period) for consumption

tion of both gas and electricity, and the present gas and electricity meter readings. The display device 12 may display entered data and if desired also instructions or prompts  
 70 before entry of data. The button 13 may be used to effect entry of data and/or subsequently to recall in series entered data, updated data, computed values, or other information.

75 At regular intervals, say daily or weekly, the user enters the updated meter readings via the keyboard 10 and the monitoring device computes the cost of consumed gas and electricity and indicates the resulting value, as an  
 80 absolute value and/or as a relative value (e.g. cost per week or other averaged period), on the display 12. In the event that the programmed target figure (which also may be absolute or relative) is exceeded the alarm 14  
 85 is actuated.

In this way the user can be made aware of the rate and extent of consumption and can anticipate or forecast the likely total expenditure at the end of the quarter or other period over which consumption is usually costed and  
 90 billed. Moreover the user can take steps to modify the rate of consumption and can readily assess the affect on consumption of different appliances.

95 In accordance with the modified version of Fig. 2, the monitoring device 1 is connected to the meters 2, 3 so as to receive readings therefrom automatically. The monitoring device 1 is otherwise as described above in  
 100 relation to Fig. 1.

The connection with the meters is effected via respective limbs 15 comprising optical transducers 16 and optical fibres 17, 18.

As shown in Fig. 2 each link 15 comprises  
 105 at least one pair of optical fibres 17, 18 which, at one end, are located respectively adjacent a light source 19 (such as an LED or bulb) and a light sensor 20 (such as a photo-transistor) within the monitoring device housing. At the other end the fibres 17, 18 are  
 110 connected to respective thin elongate lenses 21, 22 taped or bonded or fixed between transparent films secured to top and bottom regions of the front glass of the respective  
 115 meter 2, 3. The arrangement is such that light is transmitted from the source 19 along the respective optical fibre 17 to the respective lens 21 which focuses the light onto one of the dials 5 (or digit reels) to be reflected  
 120 therefrom via the other lens 22 and the other fibre 18 to the sensor 20. Whenever the dial needle (or reel) is incremented the reflected light intensity fluctuates and this is recorded by the sensor 20, and appropriate data is  
 125 thereby fed to the computing circuitry of the monitoring device 1. Where a plurality of dials is to be monitored, a corresponding plurality of pairs of fibres will be provided using the same source 19 but different respective sensors 20.  
 130

The lens arrangement is such as to permit normal visual inspection of the meter dials or reels.

The monitoring device incorporates circuitry capable of distinguishing between signals derived from the different meters 2, 3 and also the different dials (or reels).

With the modified version of Fig. 2, the monitored data may be utilised to actuate the audible alarm 14 when the target figure is exceeded, as described above. Alternatively the monitored data may be utilised to effect automatic feedback control of energy-consuming equipment such as central heating equipment. Also provision may be made for connecting the monitoring device to a domestic TV set to give a screen display in characters and/or graphics providing for example historical and/or forecasted energy consumption statistics.

Provision may also be made for receiving and processing data from other sources. For example, the device may be connected to a telephone so as to monitor its use in cost terms.

It is of course to be understood that the invention is not intended to be restricted to the details of the above embodiments which are described by way of example only.

Thus, for example, the monitoring device need not comprise a single housed unit located alongside the meters but may take any suitable form involving any desired number of units located as required. Further, as an alternative to the use of a pair of optical fibres for each dial/reel as described with reference to Fig. 2, it is possible to use bundles of fibres connected to multiple sensors for pattern recognition purposes.

Moreover, with reference to the embodiment of Fig. 2, it may be desirable to ensure that the connection of the link 15 with the front glass of the meter is unobtrusive and in particular does not obscure or appreciably distract from normal vision through the glass. This may be achieved by using superimposed transparent films which are adhered, transparently, to the glass (over its entire surface area or in one or more selected regions) and between which the ends of the optical fibres are held captive together with the thin lenses (in so far as these are in fact necessary for focusing purposes).

## CLAIMS

1. A monitoring device for use with an existing meter applied to energy or a utility or service supplied to premises, said device comprising an input means for inputting consumption data received from said meter, a computing means for computing an equivalent value in accordance with predetermined conversion data, and an output means for providing an output indicative of said computed equivalent value.

2. A monitoring device according to claim 1, wherein the input means comprises a keyboard via which a visually observed meter reading can be entered into the monitoring device.

3. A monitoring device according to claim 1, wherein the input means comprises a direct link which is connected to the monitoring device and is connected or disposed in relation to the meter so as to pick up and relay automatically meter readings.

4. A monitoring device according to claim 3, wherein the link is applied externally to the existing meter without interference with or modification of the normal operation of the meter.

5. A monitoring device according to claim 4, wherein the link includes a transducer responsive to a normal function of the meter.

6. A monitoring device according to claim 5, wherein the transducer comprises an optical device responsive to movement of an externally visible part of the meter.

7. A monitoring device according to claim 6, wherein the optical device responds to movement of said part.

8. A monitoring device according to claim 6, wherein the optical device utilises pattern recognition techniques to identify the shape or disposition of an object.

9. A monitoring device according to any one of claims 6 to 8, wherein the optical device comprises a substantially flat lens system which can be applied to the surface of a meter front glass or viewing window so as to permit normal visual inspection of the meter display whilst also acting to direct light beams onto said display from a light source and from said display after reflection thereby to a light sensor.

10. A monitoring device according to claim 9, wherein the light source and sensor are located remotely from the meter and are connected thereto via optical fibres.

11. A monitoring device according to any one of claims 1 to 10, including a clock and/or calendar for recording time and/or date of data entered from said meter.

12. A monitoring device according to any one of claims 1 to 11, wherein said computing means is operable to compute a cost value in relation to monitored rate/extent of consumption in accordance with predetermined cost data.

13. A monitoring device according to claim 12, wherein said computing means is operable to compute a forecasted said cost value.

14. A monitoring device according to any one of claims 1 to 13, wherein said output means comprises a digital display.

15. A monitoring device according to claim 1, substantially as hereinbefore described with reference to and as illustrated in Fig. 1 or Fig. 2 of the accompanying drawings.

16. A monitoring device according to any

one of claims 1 to 15, when used with a domestic gas or electricity meter.

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Printed in the United Kingdom for  
Her Majesty's Stationery Office, Dd 8818935, 1965, 4235.  
Published at The Patent Office, 25 Southampton Buildings,  
London, WC2A 1AY, from which copies may be obtained.